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Wild and semi-wild edible plants in Chilga District, Northwestern Ethiopia: Implication for food security and climate change adaptation

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The study was conducted to assess wild and semi-wild edible plants in food security and climate change adaptation in Chilga district, Northwestern Ethiopia. Various data collection methods; questionnaire survey, semi-structured interviews, Focused group discussion and market survey were employed. Field observation was conducted to check the availability of these plants in the field. Thirty-three wild and semi-wild edible plants were recorded in the study area. These plants were consumed for supplementing staple food, during emergency periods and as refreshment. Jaccard's Coefficient of Similarity in species use composition (JCS) was 0.7. These wild and semi-wild edible plants in the study area were available in different seasons. The seasonal availability of these plants implies their potential for climate change adaptation and food security throughout all seasons.

Key words: Seasonal availability, food security, wild and semi-edible plants

INTRODUCTION

Wild and semi-wild edible plants immensely contribute to family household food security and serve as means of survival during times of drought, famine, shocks and risks (Assegid and Abebe, 2011). They can also supplement nutritional requirements due to their better nutrition (Van Andel, 2006; Hunde *et al.*, 2011).

Ethiopia encompasses an astonishing number of ecological zones (IBC, 2007) and wild and semi-wild edible plants (Balemie and Kebebew, 2006; Mengistu and Hager, 2008; Teklehaymanot and Giday, 2010; Assefa and Abebe, 2011). Similarly, in Northwestern parts of Ethiopia, which is endowed with humid, sub-humid, dry, highland and lowland areas, abundant wild and semi-wild edible plants are present. However, the potential of these plants and their seasonal availability to food security and climate change adaptation is not clearly understood.

The farmers in Ethiopia face a number of challenges including deforestation, drought, land degradation, food insecurity and climate change (MoARD, 2007) which results serious food insecurity among the households (Sabates-Wheeler *et al.*, 2012). Thus, in most cases, rural communities depend on wild edible plants (Luelkal *et al.*, 2011) due to easily accessibility (Hunde *et al.,* 2011). Given climate change, level of poverty and environmental

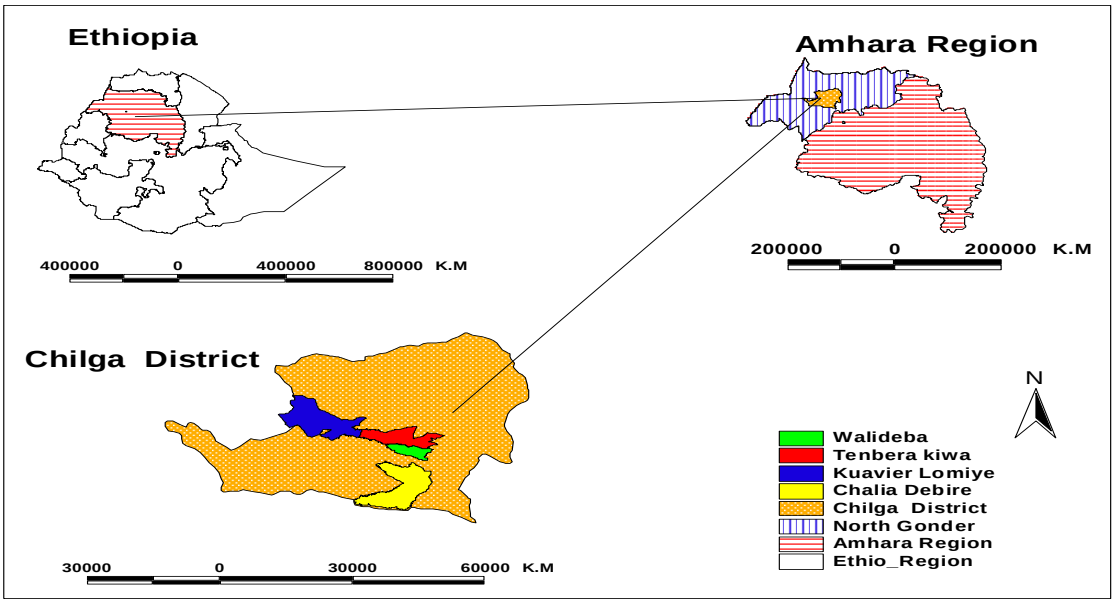

Figure 1: Location of the study sites in Chilga district, Northwestern Ethiopia

degradation there is high risk of biodiversity loss at large scale. Under such circumstances, knowledge and skills of uses and nutritious climatically adapted WEPs will be irreversibly lost. Hence, understanding wild and semi-wild edible with their respective role in food security and climate change adaptation forms a base to apply apt management. However, only 5% of the Ethiopia districts were studied (Luelkal *et al.*, 2011). Information is lacking about their potential for food security and climate change adaptation in this specific study area. Therefore, this study was initiated to i) identify the distribution of wild and semi-wild edible plants in different land uses, Kebeles and agro-ecologies in the Chilga District, (2) determine the role of wild and semi-wild edible plants in the household livelihood security and climate change adaptation.

MATERIALS AND METHODS

Site Description

The study was conducted in Chilga district, located at $12^{0}\ 55^{"}$N and $37^{0}\ 06^{"}\ E$. It has 43 administrative Kebeles (KA- the lowest administrative units next to district). The altitude of the district is generally ranging from 900 to 2267 m.a.s.l. There are two agroecologies: midland (1500-2267 m.a.s.l) and lowland (900-1500 m.a.s.l). About 33% of the district is midland, while 67 % lowland agro-ecology. There are rivers and streams traversing the district and often serving as sources of water for the population (CDOA, 2012). The major soil covers of Chilga district is 45 % Cambisols, 40 % Vertisols, 15 %, and Nitosols (CDOA, 2012). The natural vegetation of Chilga is mainly composed of various lowland and midland species (CDOA, 2012). The temperature of the district ranges from 11 to 32ºC with mean annual rainfall between 995 to 1175 mm. It had a total population of 241,712 and a total area of 3181 km^2. The livelihood of the local people is mainly based on subsistence mixed agriculture (crop-livestock production).

Selection of Study Sites

The study was carried out in four Kebeles of Chilga district from October 8 to December 20 -2012. District and Kebele experts were contacted to have general information. Secondary archived materials were also reviewed from CDOA to get additional information. The socio-demographic and biophysical characteristics of the two agro-ecologies are not the same while Kebeles in the same agroecology had similarity. Thus, based on accessibility for data collection and availability of wild and semi-wild edible plants two KAs from each agroecology (Quavier Lomiye and Tenbera Kiwa from lowland agroecology; and Walideba and Chalia Debire from midland agroecology) and two villages from each KA (Achera and Bele Wuha villages from Quavier Lomiye KA; Gint and Kilel villages from Tenbera Kiwa KA; Bete Skangie and Mehalgie villages from Walideba KA; and Ateraho and Awugiber villages from Chalia Debire KA) were selected.

Selection of Key Informants and Households

For this study, key informants (KI) are defined as knowledgeable persons about wild and semi-wild edible plants and local conditions. After selecting two villages at each KA, 24 KI (3 from each village) were selected by using snowball method to collect preliminary data and questionnaire development following the method of Bernand (2002). Then, check lists and questionnaires were prepared to interview KIs and households respectively. Twelve HH were taken in each study villages. Thus, 96 households (from the four KA, 24 households from each) were interviewed for the study assuming 5 % of the population.

Data Collection

Questionnaires and checklists were prepared, pre-tested and administered to households and KIs, respectively. All interviewees were met on a 'one-to-one' basis and asked the same standard (open- and closed-ended) questions using the local language (Amharic) based on their consent, including expansions or clarifications as needed. Information including vernacular names, parts used and consumption role, time of harvesting and fruiting was also gathered. In addition, traditional management practices, other uses, and threats of wild and semi-wild edible plants were recorded.

Repeated field observations were also conducted using transect walk where most of the wild and semi-wild edible plants are grown/cultivated. The purpose of the field observation was to obtain actual information of presence, growth habit, habitat characteristics and identification of edible plant species mentioned during the interviews. A focused group discussion of KI was also conducted at each study site to verify the data and identification of plants. All wild and semi-wild edible plants listed in the socio-economic survey were verified and idiosyncratic ideas (ideas only raised by one individual and were rejected by the group discussion) were removed from the data.

Market assessment of underutilized edible plants was conducted in Gint, Negadie Bahire, and Chandeba local markets, which are the nearest markets to the study sites to assess market price of edible plants.

All encountered plants were identified and recorded by their vernacular names. Later, converted to their botanical names using flora of Ethiopia and Eritrea (Hedberg and Edwards, 1989; Edwards *et al*., 1995; Edwards *et al*, 1997; Edwards *et al*., 2000; Hedberg *et al.,* 2004*;* Hedberg *et al.,* 2006*;* Hedberg *et al.,* 2009), and own experience. Plant specimens were collected and taken to National Herbarium of Addis Ababa University for plant identification for plants which were not identified at the field.

Data Analysis

Data collected from interviews and seasonal records of WEPs availability were quantitatively analyzed by SPSS version16 and summarized into frequency tables in percentages. Statistical analysis system (SAS) windows 9.0 was employed for Analysis of Variance (ANOVA). The data from ranking methods (direct matrix ranking and preference/priority ranking) was presented in the form of ranks. Data Graph was plotted for seasonal distribution of WEPs. Jaccard's coefficient of similarity was calculated for species use similarity between transhumant and settled farmers. JCS= c/c+b+a, where, a= number of species found only in habitat A (settled farmers), b= is number of species found only in habitat B (transhumant), c= number of species in habitat A and B. Finally, JCS was multiplied by 100, in order to obtain the percentage species composition similarity between the lowland and midland agroecologies (Ladio *et al*., 2006).

Results

Floristic composition, Habitat distribution and implication for Environmental integrity

Thirty-three wild and semi-wild (26 woody and 7 herbaceous) species were recorded in the study area (Table 3). The family Moraceae had 5 species; Malvaceae; Fabaceae and Euphorbiaceae 2 species each and the remaining families had 1 species each.

The study showed the habitats of WSEPs were natural forest, riverine forests and valleys, farmlands, boundaries, and home gardens (Table 2). Although the majority of edible plants recorded in the wild, the integration of some plants in farmlands and homegarden indicate their potential to be used in different land use systems. The growth of these plants in different habitats such as in valley, farmlands, home gardens implies the environmental role and integrity in different land use systems.

Species use composition in Lowland and Midland Agroecologies

Twenty-three (70 %) species out of 33 WSEPs were identified in both agroecologies (midland and lowland). The species use Jaccard's Coefficient of Similarity (JCS) was 0.7. Out of the total WSEPs seven species were consumed only by lowland agroecology while three edible plants utilized only in midland agroecology. Tab 1

Table 1: Species use similarity between Midland and lowland Agroecologies for WEPs and Jaccard's Coefficient of Similarity (JCS)

Spp. Use Categories	Total No. Of Spp. Identified	Total No. Of Spp. Reported			JCS	% Similarity In Species used by midland and lowland
		Midland	Lowland	Both Agroecologies		
WSEPs	33	26	30	23	0.7	70

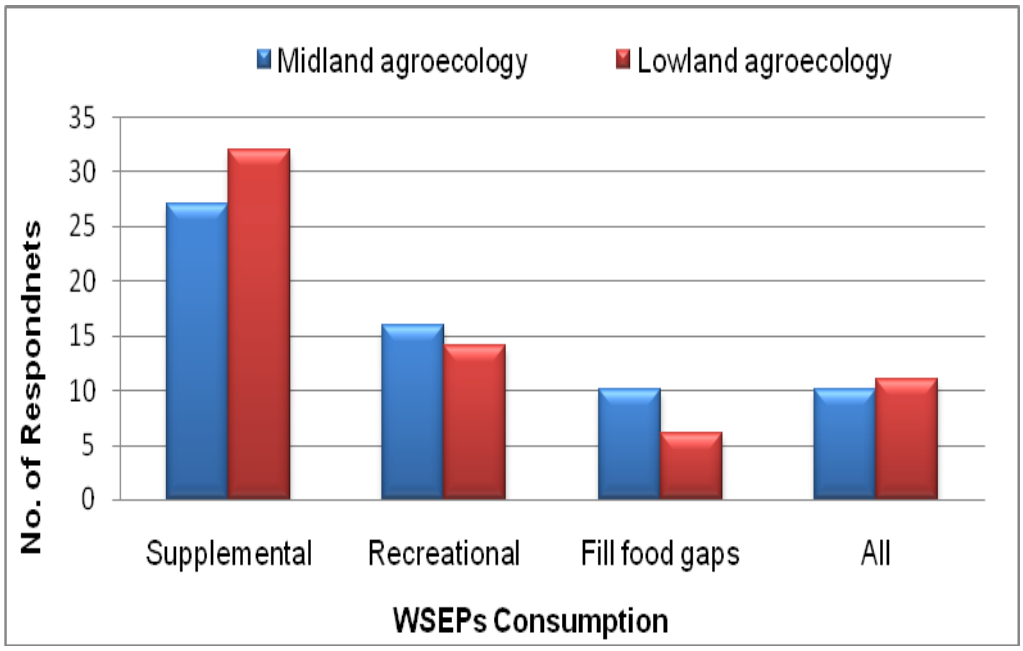

Figure 2: Consumption roles of wild an semi-wild edible plants in the study area, Northwestern Ethiopia

Consumption of WSEPs

The result of this study showed that WSEPs play an important role in maintaining food security (Figure 2). In MLA, about 27 (56 %) and 16 (33.3 %) of the respondents mentioned that WSEPs plants were consumed to supplement the staple food and recreational (refreshment) purpose, respectively. Also 21 % of the respondents consume products of underutilized edible plants during famine and drought to fill food gaps. In the LLA, 67% of the respondents mentioned that underutilized edible plants are used in the normal diet.

WSEPs in the study area provide various uses such as fuel wood, fencing, construction, soil and water conservation, shading and shelter, rope making, medicinal, fodder, timber, honey production and washing clothes as detergents in addition to food use (Figure 3).

FoT= Food and other uses; Fu=Fuel wood; FE=Fencing; CO=Construction; SC=Soil & Water conservation; FT=Farm and household tools; SH=Shade; M=Medicinal; FD=Fodder; F= Food only; T=Timber; ML

Wild and Semi-wild Edible Plants and their Socio-economic Implications

Some of the WSEPs in the study area generate income for households through either sales to domestic market or exporting to neighboring countries mainly to the Sudan (Table 2). Twelve WSEPs were marketed in local and international markets. Of the marketable edible plants *Tamarindus indica* and *Hibiscus cannabinus* were the most priced species. From marketed WSEPs majority (83 %) were marketed in the local markets and 17% exported. In general, of all marketable edible plant parts, fruit comprises the highest proportion, about 75 %.

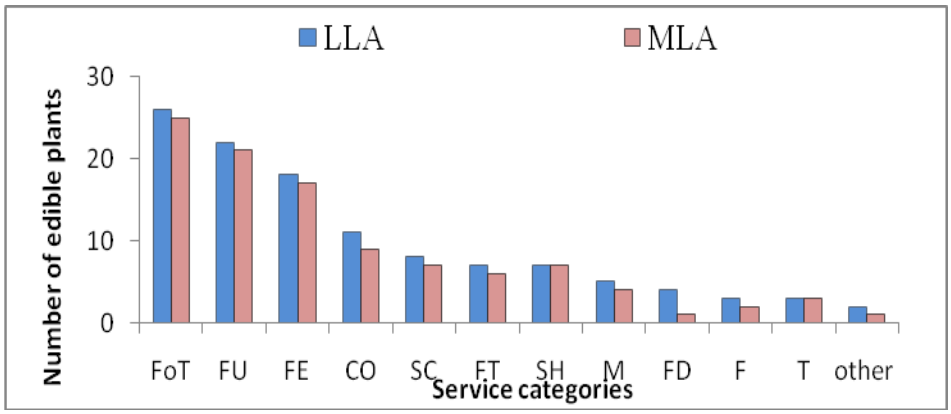

Figure 3: Use categories of underutilized edible plants in Chilga district, Northwestern Ethiopia

Table 2: List of marketable wild and semi-wild edible plants in Chilga district, Northwestern Ethiopia

Species Name	Parts Marketed	Unit	Mean Price	No. Of Respondent	Seller Group	Market Category	Rank
Carisa spinarum	F	Cup	0.83	6	younger	D	10
Corchorus olitorius	L	Handful	2.2	10	all	D	8
Diospryos mesiliformis	F	Cup	0.91	46	younger	D	2
Diospyros abyssinica	F	Cup	0.8	27	younger's	D	6
Ficus sur	F	Cup	0.63	2	younger	D	12
Hibiscus cannabinus	se	Cup	4.33	3	adult	Exp.	11
Mimusops Kummel	F	Cup	1	45	Younger's	D	3
Saba comorensis	F	No.	0.7	35	all	D	4
Syzygium guineense	F	Cup	1	64	younger's	D	1
Tamarindus indica	se	K.g	5.6	21	all	Exp.	7
Ximenia americana	F	Cup	0.95	33	younger	D	5
Ziziphus spina- christi	F	Cup	0.7	9	younger	D	9

Parts used: F=Fruit; Se= seed; L= leaf; **Market Category**: L= local market; exp. = exported to other countries; Mean unit price is expressed by Ethiopian birr (ETB); Seller age group: local classification of younger below 18 years old and adult from 18-30 year; **Note:** Ranks were given by number of respondents.

Seasonal availability of wild and semi-wild edible plants in the study area

WSEPs were harvested in different periods of the year (Table 4). According to the respondents, harvesting of WSEPs products at various seasons is due to variation of species in their fruiting calendar. Proportionally higher numbers of plants were recorded in March and June (12 species in each month). Thus, this implies that the local community can consume at any time during normal period, droughts arises; hence, can serve as an insurance response to emergency of climate change and variability.

Mode of utilization and Challenges of collection

Wild and semi-wild dible plants were eaten in fresh raw form and cooked. Seventy nine % of WSEPs were consumed the fresh uncooked form, while 21 % were eaten after cooking (Tabele 5).

Although WSEPs play an important role in food security, the utilization was constrained by different factors. The result here shows that consumption of WSEP was affected by deterioration, cultural ignorance, difficulty for collection and being choice foods (Table 6). 77.1 and 62.5 percent of the respondents said that

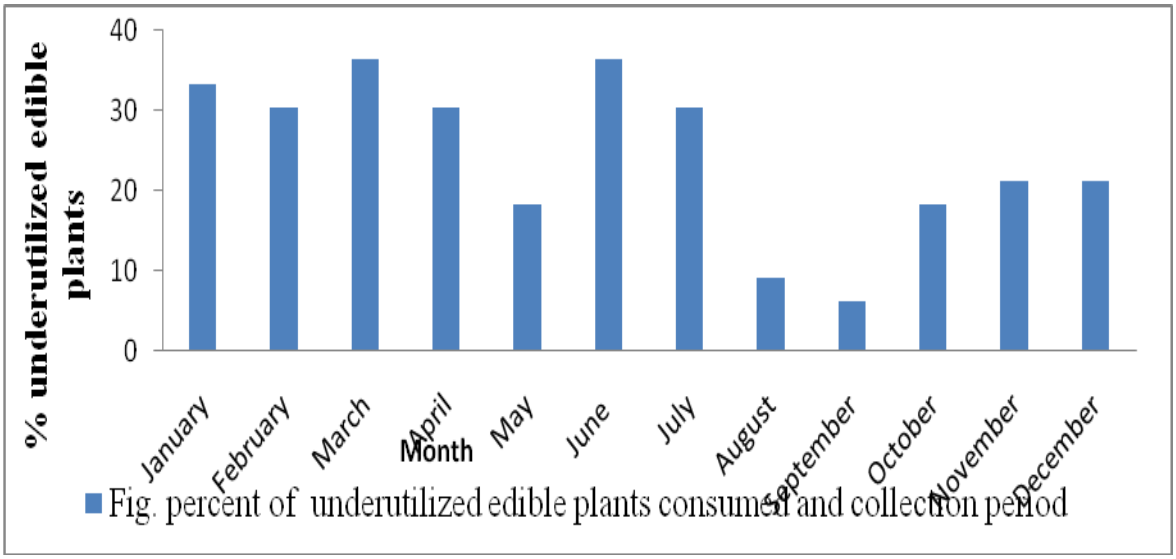

Figure 4: seasonal Percentage availability of Wild and semi-wild edible plants in Chilga District, North Western Ethiopia

Table 3: List of all wild and semi-wild edible plants encountered in Chilga district, North Western Ethiopia

Scientific name [Family]	**Vernacular Name (Amh)**	**Habit**	**Habitat**	**Added values**	**PU**	**MD**	**Vocher Number**
*Acanthus sennii Chiov. [*Acanthaceae*]*	Kushashile	SH	BN, N,R	FE, FU,	FL	F	MT-001
*Balanites aegyptiaca (L.) . [*Balanitaceae*]*	Kudekuda	T	N,R,F	FE, FU,SC,	F	F	MT-002
*Boletus edulis Bull. Ex Fries. [*Bolentaceae*]*	Enguday	H	F, N	-	ST	P	MT-003
*Carissa Spinarum L. [*Apocynaceae*]*	Agam	SH	N,R,	FE, M, FU, FT	F	F	MT-004
*Corchorus olitorius L. [*Tiliaceae*]*	Kudra	H	F	FD, Rope	L	P	MT-005
*Cordia africana L. [*Boraginaceae*]*	Wanza	T	H	T,FU, FE, FU, SH, FD, M	F	F	MT-006
*Dichrostachys cinerea Wight & Am [*Fabaceae*]*	Andera	S/ T	N	-	F	F	MT-007
*Dioscorea prahensilis Benth [*Dioscoreaceae*]*	Senssa	C	N,R	-	R	P	MT-008
*Diospyros abyssinica (Hiem) F. Wite [*Ebenaceae*]*	Serkin	T	F,R	FU,T,CO,SH, FE,	F	F	MT-009
*Diospyros mesiliformis Hochst ex.A.DC. [*Ebenaceae*]*	Gurmacha	T	F,R	T,FU,SH,CO,FE,SC	F	F	MT-010
*Dovyalis abyssinica (A. Rich.) Warburg. [*Flacourtiaceae*]*	Koshim	T	N,R	FU, FE,	F	F	MT-011
*Ficus sur Forssk. [*Moraceae*]*	Shola	T	R,F,N	CO,FE,SC,SH,FU	F	F	MT-012
*Ficus sycomorus L. [*Moraceae*]*	Bamba	T	F,N,R,H	CO,FE,SC,FD,SH, HB	F	F	MT-013
*Ficus vallis-choudae Del. [*Moraceae*]*	Bambula	T	N	FU, FE	F	F	MT-014
*Ficus vasta Forssk. [*Moraceae*]*	Warka	T	N,R,F,H	FU, CO, FE, SC,	F	F	MT-015
*Flueggea virosa Guill. & Perr. [*Euphorbiaceae*]*	Shasha	SH	F,N,R	FE, FU,CO,FU	F	F	MT-016
*Gardenia ternifolia Schumach and Thonn. [*Rubiaceae*]*	Gambilo	S/T	F,N,R	FD, FU,	F	F	MT-017
Gloriosa superba [Liliaceae]	Yemariam twa	H/sh	F	FD, WASHING	F	F	MT-018
Hibiscus cannabinus L. [Malvaceae]	Yeberha Wayika	H	F	FD	F	D	MT-019
Hibiscus esculentus L. [Malvaceae]	Wayika	H	F	M, FD,	L	D	MT-020
Maytenus senegalensis Forssk [Celastraceae]	Koshikosh	T	N,F,R	FE,FT,	F	F	MT-021

Table 3 Continued…..

Scientific name	Vernacular Name (Amh)	Habit	Habitat	Added values	PU	MD	Vocher Number
*Mimusops kummel Bruce ex A.DC. [*Sapotaceae*]*	Ishe	T	R,F	FE,FU,HB,CO,	F	F	MT-022
*Morusmeso zygia [*Moraceae*]*	Injori	C	N, R	-	F	F	MT-023
*Pittosporum viridiflorum Sims. [*Pittosporaceae*]*	Dengay Seber	S	N,F, R	FU	F	F	MT-024
*Rhus glutinosa A. Rich. subsp. Abyssinica (Oliv.) M. Gilnert [*Anacardiaceae*]*	Qamo	S	N, R	Fe, FU	F	F	MT-025
*Rosa abyssinica Lindley [*Rosaceae*]*	Qega	SH	N	FE,FU,	F	F	MT-026
*Saba comorensis (Bo).) Pichon [*Apocynaceae*]*	Ashama	C	R	CO, SH,	F	F	MT-027
*Sporobolus africanus (Poir) Robyns and Tournay [*Poaceae*]*	Muriye	H	N,FLD,R	FD	S	D	MT--028
*Syzygium guineense (Willd.) DC. [*Myrtaceae*]*	Dokima	T	R,F	M, FE, FU, SH, CO	F	F	MT-019
*Tamarindus indica L. [*Fabaceae*]*	Kumer	T	R,N,F	FE,FU,CO,SC	S	D	MT-030
*Ximenia americana L. [*Olacaceae*]*	Enkoye	Sh	N	FU,M	F	F	MT-031
*Ziziphus abyssinica Hoschst. [*Rhamnaceae*]*	Abetere	T	F,N,R,	Fu, Fe	F	F	MT-032
*Ziziphus spina-christi Willd. [*Rhamnaceae*]*	Arka	S/T	N	Fe,Fu, co,Fd,sc	F	F	MT-033

Key to abbreviations: Habit; Sh = Shrub; T = Tree; H= Herb; C=climber; **Habitat:** N = Natural forest; F= Farm land; R; Riverine and valley; H=Home garden; Fld= Field/range lands/. BN = boundary; **Added value**: Fu = Fuel wood; CH= Charcoal; M= Medicinal; CO = Construction; Fe = fencing; SC= Soil and water conservation; FD =Fodder; Sh= Shade; HB =Production; T= Timber; FT= Farm and household tools. PU (**Parts Used):** F= Fruit; R =Root; Fl = flower nectar; S= seed; W= Whole part. **Mode of utilization** (MD)**:** F= Fresh; P =Prepared/Cooked; D =Dried and Prepared.

WSEPs were difficult to harvest in mid-land and lowland ecologies respectively.

DISCUSSION

Floristic Composition, Distribution and Diversity of underutilized Edible plants

A good number of edible plants (33 species) are recorded compared to other areas in Amhara region (Mengistu and Hager, 2008). These underutilized edible plants include trees, shrubs and herbs. Most of the edible plants are documented elsewhere in Ethiopia for instance; 6 species are found in semi-arid lowlands of Southern Ethiopia (Assefa and Abebe 2011); 7 species in Derashe and Kucha, Southern Ethiopia (Balemie and Kebebew, 2006); 20 species in Amhara region, Northern Ethiopia (Mengistu and Hager, 2008); 20 species in Northern Ethiopia, 8 species in South-eastern Ethiopia, 5 species in Eastern Ethiopia, 6 species in Southeastern Ethiopia (Teketay and Eshete, 2004). The existence of these plants in different regions of the country indicates their ecological adaptation in large geographical area and their edibility by different ethnic groups.

Natural forests, riverine areas and farmlands were house of underutilized edible plants in the study sites in both MLA and LLA. These land uses are also the homes to numerous underutilized plants in Ethiopia (Balemie and Kibebew, 2006; Asfaw, 2009; Mengistu and Hager, 2008; Teketay & Eshete, 2004). Forests provide livelihoods and food for some 300 million people in the form of non-timber forest products in the world (Bharucha and Pretty, 2010). Again, their distribution ranges in different agroecologies due to variation of species physiological adaptation (Baleme and Kebebew, 2006).

Trees followed by shrubs were the dominant growth forms of underutilized edible plants in the study area. Although relatively small in number, herbaceous plants also were consumed. The report by Mengistu and Hager (2008) in Amhara region and Teklehaymanot and Giday (2010) in the lower river valley of Debub Omo Zone was consistent with the present finding that trees were the leading growth form. On the contrary, Lulekal *et al*. (2011) indicates shrubs were the dominant growth forms in Ethiopia followed by trees, herbs and climbers, respectively. Fruits were the commonly utilized edible parts in the study area. In harmony with this finding, Lulekal *et al*. (2011) and Addis *et al.* (2005) found fruits as the widely used parts.

Potential contribution to food security and socio-economic implication

Seasonal food shortages, when household stocks were empty and the new crop were still in the field were common times to dowel on collecting, selling and consuming WSEPs in the study area. Similarly WSEPs in different parts of Ethiopia were utilized to fill the seasonal food gap (Guinand and Lemmessa, 2000; Getachew,

Table 4: Fruiting calendars of all Wild and semi-wild edible plants in Chilga district, North Western Ethiopia

Scientific name [Family]	**Vernacular Name (Amh)**	**Fruiting month**											
		J	**F**	**M**	A	**MA**	**JUN**	**JUL**	**AU.**	**SEP.**	**OCT.**	**NOV.**	**DEC.**
*Ximenia americana L. [*Olacaceae*]*	*Enquay*	0	0	0	0	+	+	+	0	0	0	0	0
*Diospyros mesiliformis Hochst ex.A.DC. [*Ebenaceae*]*	*Gurmacha*	+	0	0	0	0	0	0	0	0	0	+	+
*Ficus sycomorus L. [*Moraceae*]*	*Bamba*	+	+	+	+	0	0	0	0	0	0	0	0
*Balanites aegyptiaca (L.) . [*Balanitaceae*]*	*Kudekuda*	+	+	+	+	0	0	0	0	0	0	0	+
*Syzygium guineense (Willd.) DC. [*Myrtaceae*]*	*Dokima*	0	0	0	+	+	+	0	0	0	0	0	0
*Mimusops kummel Bruce ex A.DC. [*Sapotaceae*]*	*Ishe*	0	0	+	+	0	0	0	0	0	0	+	+
*Cordia africana L. [*Boraginaceae*]*	*Wanza*	+	+	+	0	0	0	0	0	0	0	0	0
*Rhus glutinosa A. Rich. subsp. Abyssinica (Oliv.) M. Gilnert [*Anacardiaceae*]*	*Qamo*	0	0	0	0	0	0	+	+	0	0	0	0
*Carissa Spinarum L. [*Apocynaceae*]*	*Agam*	0	0	0	0	0	+	+	0	0	0	0	0
*Dioscorea prahensilis Benth [*Dioscoreaceae*]*	*Sinsa*	+	+	+	+	+	+	+	+	+	+	+	+
*Diospyros abyssinica (Hiem) F. Wite [*Ebenaceae*]*	*Serkin*	+	+	+	0	0	0	0	0	0	0	0	0
*Ziziphus abyssinica Hoschst. [*Rhamnaceae*]*	*Abetere*	+	+	+	0	0	0	0	0	0	0	0	0
*Ficus sur Forssk. [*Moraceae*]*	*Shola*	0	0	+	+	+	0	0	0	0	0	0	0
*Ficus vasta Forssk. [*Moraceae*]*	*Warka*	+	+	0	0	0	0	0	0	0	0	0	0
*Saba comorensis (Bo).) Pichon [*Apocynaceae*]*	*Ashama*	0	0	0	0	0	+	+	0	0	0	0	0
*Ziziphus spina-christi Willd. [*Rhamnaceae*]*	*Arka*	+	+	+	+	0	0	0	0	0	0	0	0
*Ficus vallis-choudae Del. [*Moraceae*]*	*Bambula*	0	0	+	+	0	0	0	0	0	0	0	0
*Dichrostachys cinerea Wight & Am [*Fabaceae*]*	*Andera*	0	0	0	0	0	0	0	0	0	+	+	0
Gloriosa superba [Liliaceae]	*Ymariam Tiwa*	0	0	0	0	0	0	0	0	0	+	+	0
Maytenus senegalensis Forssk [Celastraceae]	*Koshikosh*	+	0	0	0	0	0	0	0	0	0	+	+
*Boletus edulis Bull. Ex Fries. [*Bolentaceae*]*	*Enguday*	0	0	0	0	0	+	+	0	0	0	0	0
*Acanthus sennii Chiov. [*Acanthaceae*]*	*kushashile*	0	0	0	0	0	0	0	0	0	+	+	0
*Dovyalis abyssinica (A. Rich.) Warburg. [*Flacourtiaceae*]*	*koshim*	0	0	0	+	+	0	0	0	0	0	0	0
*Gardenia ternifolia Schumach and Thonn. [*Rubiaceae*]*	*Gambilo*	0	0	0	+	+	0	0	0	0	0	0	0
*Pittosporum viridiflorum Sims. [*Pittosporaceae*]*	*Dengia seber*	0	0	0	0	0	+	+	0	0	0	0	0
*Rosa abyssinica Lindley [*Rosaceae*]*	*Qega*	0	+	+	0	0	0	0	0	0	0	0	0
*Morusmeso zygia [*Moraceae*]*	*Injory*	0	0	0	0	0	+	+	0	0	0	0	0
*Tamarindus indica L. [*Fabaceae*]*	*kumer*	+	+	+	0	0	0	0	0	0	0	0	+
*Corchorus olitorius L. [*Tiliaceae*]*	*Kudra*	0	0	0	0	0	+	+	+	0	0	0	0
Hibiscus esculentus L. [Malvaceae]	*Wayika*	0	0	0	0	0	+	+	+	0	0	0	0

Table 4 continued…….

*Sporobolus africanus (Poir) Robyns and Tournay [*Poaceae*]*	*Muriye*	0	0	0	0	0	0	0	0	+	+	0	0
Hibiscus cannabinus L. [Malvaceae]	*Yeberha Wayika*	0	0	0	0	0	+	+	+	0	0	0	0
*Flueggea virosa Guill. & Perr. [*Euphorbiaceae*]*	*Shasha*	0	0	0	0	0	+	0	0	0	0	0	0
	Total	11	10	12	10	6	12	10	3	2	6	7	7

Abbreviations of fruiting months from J to Dec. are all months from January to December.

2005; Hunde *et al*., 2010; Hunde et al.; 2011). Again, WSEPs are also consumed to supplement the nutrition of staple foods which is the solution to hidden hunger (hunger due lack of balanced diet). In line with the present study, other findings elsewhere indicated that their nutrition supplement role (Mengistu and Hager, 2009; Hunde *et al*., 2010; Hunde *et al*., 2011). The poorest community in the study area cited greater numbers of plants. Poor communities do not have any other alternatives to secure their food demand and thus more dependent on WSEPs (Luelkal *et al.*, 2011). Since WEPs are freely accessible within natural habitats, indigenous people have knowledge of how to gather and prepare the foods (Somnasang and Moreno-Black, 2000). This also implies their potential contribution in food security. Seasonal food shortages, when household stocks were empty and the new crop was still in the field were common times to dowel on collecting, selling and consuming underutilized edible plants. Marginalized and poorest communities are more vulnerable to drought thus are more dependent on these plants (Luelkal *et al.,* 2011; Bharucha and Pretty, 2010; Asfaw, 2009; Guinand and Lemmessa, 2000). The rural community of this study especially in the lowland Kebles preferred some species like *Corchorus olitorius* more than other vegetables due to its nutritional value. Thus, local peoples in the study area are passing the hidden hanger (nutritional insecurity) by consuming these plants. The nutritional richness of most plants listed in the study area are also reported by other authors (Hunde *et al*.,2011; Pauline and Linus, 2004).

Once more, most of WSEPs provide different service categories in addition to food value. Different researchers elsewhere in Ethiopia also noted multiple purposes such as preparation of remedies, fuel wood, fencing, construction and timber, farm and household implements and livestock fodder (Balemie and Kebebew, 2006; Teklehaymanot and Giday, 2010; Abebe and Ayehu, 1993; Mengistu and Hager, 2008). Marketable edible plants such as *X. americana, S. guineense, T. indica, C. spinarum* and *M. kummel* supplement household income. Some of the species that contribute for income generation in this area include *S. guineense, T. indica, C. spinarum* and *M. kummel* were reported in other areas (Baleme and Kebebew, 2006; Mengistu and Hager, 2008). Besides, income is fetched from selling of stems and branches (Baleme and Kebebew, 2006; Assefa and Abebe, 2011). *C. africana* for instance, is one of the most widely used edible plants in the study area, which were preferred for timber production.

Implication of seasonal availability of WEPs to human well being and environmental integrity

Thirty three WSEPs identified in the study area were used as food. Most of these identified species provide other benefits besides food value. This can increase diversity of income, food, and healthcare system of the community. Hence, the serve as biological insurance for food and local healthcare system as they are being year round available. They also satisfy the need of local material, spiritual and cultural needs. WSEs were grown in different habitats like in natural forests, homesteads, valley and riverine areas in both lowland and midland agroecologies. Their growth in different agroecologies and habitats can increase resilience of ecological niches contribution to environmental reliability. Their potential existence in homesteads and scattered in farmland show their potential to existence of dryland agroforestry systems. The seasonal availability of WSEPs keeps the indigenous knowledge system (Ethnobotanical knowledge) of the area, which increases the confidence of people's dependence on natural resources as their own property. Again, most of the identified WSEPs species were native to that environment. Hence, the do not show any environmental integrity problem unlike exotic species rather they can contribute to the conservation of soil and water, thus reducing moisture stress in the area.

Fruiting calendar and innate resilience of WSEPs to climate change adaptation

WEPs identified in the study area were available year round at different seasons. The fruiting of WSEPs during all season especially at dry season has indicated that the innate resilience nature of these plants to water stress environments, which is often missed in exotic species.

Table 5: Mode of utilization for wild and semi-wild edible plants in Chilga district, Northwestern Ethiopia

	Mode of utilization		
Total No. of WSEPs identified	**Eaten Fresh Uncooked**	**Eaten dried Cooked**	**Eaten Fresh Cooked**
33	26	5	2

Table 6: Problems of wild and semi-wild edible plants in the study area

	Difficulty for collection		Deterioration		Choice food		Cultural ignorance	
Altitude	**No. of respondent**	**%**	**No. of respondent**	**%**	**No. of respondent**	**%**	**No. of respondent**	**%**
Mid- land(N=48)	37	77.1	24	50.0	3	6.3	10	20.8
Lowland(N=48)	30	62.5	12	25.0	14	29.2	17	35.4

Since most of the plants were drought resistant, they were found producing fruits, unlike staple food crops which failed during drought and erratic rainfall availability. Thus, their year round presence will help the community to pass difficult periods and serve as a means of climate change adaptation during stable crop failure. Hence, integrating both productions can enhance production and food security systems of the community. Moorhead (2009) described the role of WSWEPs as back-up of insurance for small-scale farmers who can lose everything if there is a weather 'shock'.

According to some respondents, the surface temperature of the area is currently increasing. The informants and CDOA (2012) told the peoples in Chilga district migrate from midland areas to lowland areas in search of agricultural and grazing land due increasing population growth and shortage of land in midland environment. The migrants clear the forests in lowland environments for fuel wood, agricultural land and for other uses. As resource degradation increases and land use system changed from forest to agricultural land, the fixation of carbon by vegetation decreases. The reduction of Carbon fixation by vegetation increases surface CO2 and surface temperature. Thus, consumption and integration of these plants in different land uses such as in agroforestry might be one of the mechanisms to cope with effects of this climate/temperature variability.

Mode of Consumption and Challenges of WEPs Collection and Use

Most of the WSEPs were found to be eaten fresh and raw as snacks or sometimes potion. Fruits of some species like Z.christi, Tamarind and Ficus species are eaten both at their fresh and dry states while V. madagascariensis fruits are consumed dried. Some species of fruits and leaves such as *Corchorus olitorius* were subject to some home processing as boiling, roasting and cooking. Farmers and herders go distant area for farming activities and grazing of animals. These communities consumed fresh and raw WESPs when they hunger in their work place.

The majority of respondents across the study areas complained about the consumption WSEPs. Since most of edible plants were trees and some were thorny which were difficult to climb or collect. Deterioration of easily and cultural ignorance were the second and third problems of WSEPs. Given that most of the plant parts fruits and leaves which were eaten raw and fresh, they perishable and deteriorate easily. The local taboos also seem to dread fully depress the consumption of WSEPs in general. Studies elsewhere in Ethiopia also show that utilization of WSEPs was complained with similar problems of current study area (Mengistu and Hager, 2008).

CONCLUSION AND RECOMMENDATIONS

Chilga district, located in Amhara region, Northwestern Ethiopia is endowed with diverse WSEPs. A total of 33 WSEPs (22 families) were recorded. These plants are found lowland and midland agroecologies distributed in natural forests, riverine forests and in farmlands.

WSEPs are consumed for supplementing staple food, filling food gaps and recreational value and the consumption is higher by poorest community. The products of WSEPs were produced in different months of the year. Most WSEPs provide other services including medicinal value, fuel wood and charcoal, construction, timber, farm and household implements, generating income from selling the products and their parts, which implies their potential for food security and climate change adaptation.

The study focus on WSEPs and their implication for food security and climate change adaptation. Further study on their contribution in climate change mitigation and nutritional analysis should be done for these identified edible plants. Data on market price of edible plants needs continuous recording at the market for one year or longer. This necessitates further detailed market survey, quantification and economic valuation WSEPs.

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